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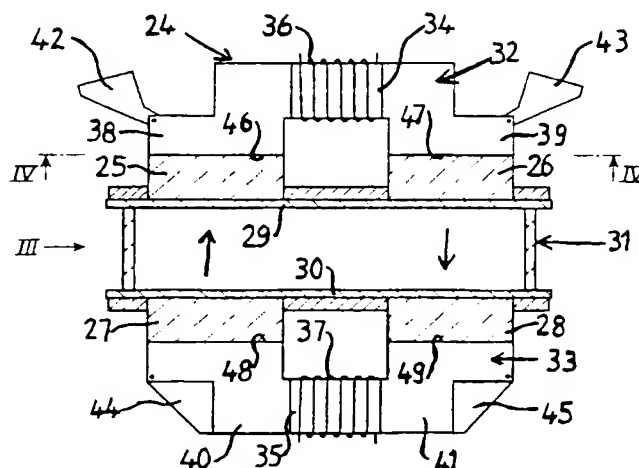
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(54) Title: A DEVICE FOR CONTINUOUS OR SEMI-CONTINUOUS CASTING OF METALS



(57) Abstract: A device for continuous or semi-continuous casting of metals comprises an electromagnetic brake comprising at least two magnetic cores (25, 26; 27, 28), arranged on one side of a mould (31) and attached thereto, and a yoke (32, 33) which is detachably connected to the two magnetic cores (25, 26; 27, 28) and interconnects them. The yoke (32, 33) carries at least one coil (36, 37). The coil (36, 37) is wound around the yoke (32, 33) substantially between the two magnetic cores (25, 26; 27, 28) interconnected by the yoke (32, 33). The yoke (32, 33) has two separate surfaces (46, 47; 48, 49) being adapted to detachably abut against one magnetic core (25, 26; 27, 28) each, and the coil (36, 37) is wound around the yoke (32, 33) substantially between said surfaces (46, 47; 48, 49).

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A device for continuous or semi-continuous casting of metals

10 FIELD OF THE INVENTION

The present invention is related to a device for continuous or semi-continuous casting of metals. It comprises in particular an electromagnetic brake comprising at least two magnetic cores arranged on one side of a mould and attached thereto, and a yoke which is detachably connected to the two magnetic cores and interconnects them.

Electromagnetic brakes comprise arrangements for generation of a static, magnetic field generated through direct current or a magnetic field generated through permanent magnets or an alternating, low-frequency pulsating magnetic field in the liquid metal in a mould in a device for continuous or semi-continuous casting of metals. When the metal flowing in passes the field, the movement of the tap jet into the rest of the liquid metal is retarded by the field and the tap jet is split such that its impulse is weakened or ceases. The main principles for the function and the advantages with such electromagnetic brakes are well known since earlier.

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The field of the invention includes in particular devices for casting of "slabs", where the mould has a rectangular cross section and opposite pairs of magnetic cores are arranged along the opposite long sides of the mould and connected to a yoke each.

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BACKGROUND OF THE INVENTION AND PRIOR ART

According to prior art it is known to arrange electromagnetic brakes of the initially defined kind, where each magnetic core is divided into a front part being permanently arranged at the mould and a back part being detachably connected to the front part. Each back core part carries a coil and each of the coils is wound substantially parallel to the mould wall around the back magnetic core part. The front part of the magnetic core can have the shape of a plate or similar comprising a magnetic material and being permanently connected to the mould. The back part has a surface for abutment against the front part which has an area and a geometry which is adjusted to the area and the geometry of the front part which in its turn is depending on the size of the mould among other things.

A drawback with prior art devices is that they require individual adjustment of the magnetic core part around which the coils are wound for different moulds of different size and the shape and size of the magnetic cores which are used differ from case to case.

Prior art magnetic cores in addition take up a relatively large space in a direction perpendicularly out from the mould wall.

THE OBJECT OF THE INVENTION

An object of the present invention is to provide a device for continuous or semi-continuous casting of metals comprising an electromagnetic brake, which is designed such that it simply can be adjusted to different mould sizes. In addition, the yoke and the magnetic cores shall be arranged in a way such that a compact brake, which extends as little as possible from the mould wall, is achieved, for enabling access of devices situated under the brake, for instances lifting devices.

At least a part of the yoke shall furthermore be easy to mount and dismount from the magnetic cores arranged at the mould.

SUMMARY OF THE INVENTION

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The object of the invention is achieved by means of a device of the initially defined kind, being characterized in that the yoke carries a coil and that the coil is wound around the yoke substantially between the two magnetic cores interconnected by the yoke. The placement of the coil on the yoke results in that some magnetic core parts do not need to carry any coil and be limited by the coil in the same way as with prior art devices. They can easily be extended or shortened in the longitudinal direction of the yoke, that is along the width of the mould.

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The mould is preferably rectangular transversal to the casting direction and has two opposite long sides, along one of which the yoke extends substantially parallel thereto, and the coil is preferably wound around the yoke such that the centre axis of the coil is substantially parallel to said long side and extends perpendicularly to the casting direction in the mould. Such an arrangement is advantageous from a space saving point of view and in addition leads to that the coil, or the part of the yoke around which the coil is wound, can be made easily accessible and exchangeable but can also give access to devices placed under the brake, for instance lifting devices. Preferably, the magnetic cores are arranged with a space therebetween, the coil being positioned substantially right in front of said space. The coil can with advantage be allowed to push into said space in order to save space.

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According to a preferred embodiment of the device, the yoke comprises a portion, which is detachable from the rest of the yoke and carries the coil. Preferably, the yoke comprises two yoke parts, arranged on opposite sides of said portion, forming a cradle in which said yoke portion can rest and having a surface

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each adapted to abut against a respective magnetic core. The cradle defined by said yoke parts is preferably arranged to allow a displacement of the coil carrying portion substantially vertically out of said cradle in order to facilitate exchange and maintenance of the coil or parts of the device being located vertically under the coil and which would otherwise be hard to access. The yoke parts which are arranged on opposite sides of the coil carrying yoke portion can easily be adjusted to different mould widths, or more particularly magnetic core widths, by adjustment of their length.

A further object of the invention is to provide a yoke, which is constructed such that the electromagnetic brake can easily be adjusted to different mould widths without the coil or the coils arranged on the brake constituting any substantial obstacle of such an adjustment. Furthermore, the yoke shall be designed according to a principle, which favours a very little space consuming construction of the electromagnetic brake of which the yoke is a part.

This object is achieved by means of a yoke according to the preamble of patent claim 13, which is characterized in that it carries a coil being wound around the yoke substantially between said surfaces. Said surfaces are two separate surfaces of the yoke which are adapted to detachably abut against one magnetic core each of two magnetic cores arranged at a mould. The yoke is moreover preferably arranged and designed in the way described above with reference to the device according to the invention.

Further advantages and characteristics of the invention and the yoke according to the invention will appear from the following description and the appended patent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the device according to the invention will hereinafter be described as an example more in detail with reference to the appended drawing, on which:

Fig 1 is a schematic view from above of the device according to prior art,

Fig 2 is a schematic, cross section view from above of the device according to the invention,

Fig 3 is a schematic, cross section view according to III-III in Fig 2, and

Fig 4 is a schematic, cross section view according to IV-IV in Fig 2.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Fig 1 shows a prior art device for continuous or semi-continuous casting of metals, the device comprising an electromagnetic brake 1. The device furthermore comprises a copper mould 2 of a kind known per se on opposite sides of which the electromagnetic brake 1 is arranged. The electromagnetic brake 1 comprises a number of magnetic cores 3, 4, 5, 6 connected to the mould wall. The magnetic cores 3-6 are arranged in pairs on opposite sides of the mould along the long sides 7, 8 thereof and cover substantially the entire width of the mould except for a centre portion of the mould. The magnetic cores 3, 4 and 5, 6, respectively, of each magnetic core pair are connected by means of a yoke 9, 10.

The magnetic cores 3, 4 and 5, 6, respectively, are welded into windows in so called backup plates 11, 12 made from stainless

steel and forming support walls for the copper sheets of the mould.

Each magnetic core 3-6 comprises a magnetic core part 14-17 carrying a coil 18-21. The coil carrying magnetic core parts 14-17 are preferably detachably connected to front magnetic core parts, being welded into the windows in the backup plates 11, 12. The yokes 9, 10 are detachably connected, for instance fastened by bolts, at the magnetic cores 3, 4 and 5, 6, respectively. The coils 18, 19, 20, 21 are wound substantially parallel to the mould wall around the back magnetic core parts 14, 15 and 16, 17, respectively.

When a current flows through the coils 18, 19, 20, 21, a magnetic field is obtained with a direction being indicated through the arrows in Fig 1.

Figs 2-4 show an embodiment of the device according to the invention, which shows an improved further development of the device according to Fig 1. As in the device according to Fig 1, the device according to the invention comprises an electromagnetic brake 24, comprising two pairs of magnetic cores 25, 26 and 27, 28, respectively, arranged along opposite long side walls 29, 30 of a copper mould 31 known per se. The magnetic cores 25-28 are arranged in a way corresponding to Fig 1 and serve to contribute to a generation of a magnetic field similar to the one described for the device according to Fig 1. However, the magnetic cores are not divided into front and back parts, where the back parts carry coils, which is the case in Fig 1.

The magnetic cores 25, 26 and 27, 28, respectively, of each magnetic core pair are connected by means of a yoke 32, 33. Each yoke 32, 33 comprises a portion 34, 35, on which a coil 36, 37 is wound, each such portion being positioned substantially right in front of a space between the two magnetic cores 25, 26

and 27, 28, respectively, interconnected by the yokes 36, 37. The yokes are detachably connected to the magnetic cores.

On opposite sides of the coil carrying portion 34, 35, the yokes
5 32, 33 comprise two further parts 38, 39 and 40, 41, respectively, forming a cradle for the coil carrying portion 34, 35 and having surfaces 46-49 for abutment against the respective magnetic cores 25-28. The coil carrying portions 34, 35 are detachably attached, here fastened by bolts from above, to the further
10 parts 38, 39 and 40, 41, respectively. The cradle defined by the further parts 38, 39 and 40, 41 is such that it allows displacement of the coil carrying portions 34, 35 substantially vertically upwards. In that way the coils 36, 37 can be easily dismounted and exchanged if required. The coil carrying portions 34, 35 can
15 have the shape of a circular or square bar of magnetic material, around which the coils 36, 37 are wound.

The yokes 32, 33 furthermore comprise a number of pivoted portions 42-45, here being arranged to be pivoted substantially
20 horizontally to enable access of parts of the device being situated under the electromagnetic brake 24 and which may need to be accessed for exchange and maintenance. The pivoted parts 42-45 form part of the parts 38-41 described above which are arranged on opposite sides of the coil carrying portions 34, 35
25 and connected thereto.

Typical parts included in the device and situated under the electromagnetic brake 24 and which must be made accessible are for instance lifting devices for lifting the mould with underlying segments, and parts requiring exchange and maintenance,
30 for instance cylinders which are used for control of the metal string being continuously cast by means of the device.

The yokes 32, 33 could comprise further parts or portions, but
35 the proposed solution is sufficient for enabling a fast and simple adjustment of the yoke size to different mould widths, that is

magnetic core widths. Suitably the coil carrying portions 34, 35 have a standard size and the length of the further parts 38-41 is adjusted with reference to the width of the mould/magnetic core.

5 It is to be understood that the device according to the invention normally comprises a large number of further components which, however, for the sake of clarity not have been shown in the appended drawings. Examples of such components are
10 cooling loops arranged around the mould, as well as different components arranged around the electromagnetic brake and limiting the space, which the electromagnetic brake can be allowed to occupy. An idea of the invention is that yokes of the kind according to the invention shall be possible to be supplied to already existing devices for continuous or semi-continuous casting
15 of metals and be mounted thereon, without any complicated adjustment of the brake which the yoke is part of being required on each single occasion.

The yokes 32, 33 preferably have the shape of bars or plates.
20 The coil carrying portions 34, 35 can be supplied separately to a user of a device for continuous or semi-continuous casting of metals, who then easily cuts and shapes the further parts 38-41 himself from a suitable bar material.

25 The yokes 32, 33, the magnetic cores 25-28 and the coils 36, 37 are arranged to generate a static magnetic field generated through direct current or a magnetic field generated through permanent magnets or an alternating, low-frequency pulsating magnetic field in the liquid metal in the mould of the device.

30 A plurality of variants and alternative embodiments of the device according to the invention will of course be apparent for a man skilled in the art without departing from the scope of the invention, such as this is defined in the appended claims with support
35 from the description and the drawings.

For instance the further yoke parts 38-41 situated on the side can just as well be considered as back magnetic core parts being detachably connected to the front magnetic core parts, here the cores 25-28, being permanently attached to the mould. However, it is important to note that existing coils 36, 37 only are mounted on yoke parts, of which the size and shape, at least over the cross section where the coil is arranged, are substantially independent of the mould size and the area of the magnetic cores against the copper wall of the mould.

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Yokes and magnetic cores are all made of a magnetic material, preferably iron.

Claims

1. A device for continuous or semi-continuous casting of metals, comprising an electromagnetic brake which comprises
5
- at least two magnetic cores (25, 26; 27, 28), arranged on one side of a mould (31) and attached thereto, and
- a yoke (32, 33), which is detachably connected to the two magnetic cores (25, 26; 27, 28) and interconnects them,
10 characterized in that said yoke (32, 33) carries at least one coil (36, 37), substantially between the two magnetic cores (25, 26; 27, 28) interconnected by the yoke (32, 33).
2. A device according to claim 1, characterized in that the
15 mould (31) is rectangular transversal to the casting direction and has two opposite long sides (29, 30), along one of which the yoke (32, 33) extends substantially parallel thereto and that the coil (36, 37) is wound around the yoke (32, 33) such that the centre axis of the coil (36, 37) is sub-
20 stantially parallel to said long side (29, 30).
3. A device according to claim 2, characterized in that the
25 centre axis of the coil (36, 37) extends substantially perpendicularly to the casting direction in the mould (31).
4. A device according to any of claims 1-3, characterized in
that the magnetic cores (25, 26, 27, 28) are permanently secured to the mould (31).
- 30 5. A device according to any of claims 1-4, characterized in that the magnetic cores (25-28) are arranged with a space therebetween and that the coil (36, 37) is positioned substantially right in front of said space.
- 35 6. A device according to any of claims 1-5, characterized in that the yoke (32, 33) substantially defines a bar or plate, and

that the coil (36, 37) is wound around a centre portion (34, 35) of the bar or plate.

- 5 7. A device according to any of claims 1-6, characterized in that the magnetic cores (25, 26; 27, 28) cover substantially the entire width of the mould (31), except for a centre portion of the mould (31).
- 10 8. A device according to any of claims 1-7, characterized in that the yoke (32, 33) comprises a portion (34, 35) which is detachable from the rest of the yoke (32, 33) and carries the coil (36, 37).
- 15 9. A device according to claim 8, characterized in that the yoke (32, 33) defines a cradle arranged to receive the portion (34, 35) carrying the coil (36, 37) and allow displacement of said portion (34, 35) substantially vertically out of said cradle.
- 20 10. A device according to claim 9, characterized in that the yoke (32, 33), in addition to said portion (34, 35) carrying the coil (36, 37), comprises two yoke parts (38, 39; 40, 41), arranged on opposite sides of this portion (34, 35), forming said cradle and each having a surface (46, 47; 48, 49) adapted to abut against a respective magnetic core (25, 26; 27, 28).
- 25 11. A device according to any of claims 1-10, characterized in that the yoke (32, 33) comprises at least one portion (42-45) being detachably connected to the rest of the yoke (32, 33) and arranged to be detached for access of parts of the device which are arranged vertically under the electromagnetic brake.
- 30 12. A device according to claim 11, characterized in that said portion (42-45) is a peripheral portion of the yoke (32, 33) being pivoted relative to the rest of the yoke (32, 33).
- 35

13. A yoke for an electromagnetic brake (24) of a device for continuous or semi-continuous casting of metals, comprising two separate surfaces adapted to detachably abut against one magnetic core (25, 26; 27, 28) each of two magnetic cores (25, 26; 27, 28) arranged on one side of a mould (31),
5 characterized in that it carries a coil (36, 37) being wound around the yoke (32, 33) substantially between said surfaces (46, 47; 48, 49).
- 10 14. A yoke according to claim 13, characterized in that it is elongated, that said surfaces (46, 47; 48, 49) extend substantially in parallel with its longitudinal direction and that the coil (36, 37) is wound transversal to said longitudinal direction such that its centre axis is substantially parallel to the
15 longitudinal direction.
15. A yoke according to claim 13 or 14, characterized in that it comprises a portion (42, 43; 44, 45) which is detachable from the rest of the yoke and carries the coil (36, 37).
20
16. A yoke according to claim 15, characterized in that it defines a cradle arranged to receive the portion (34, 35) carrying the coil (36, 37) and allow displacement of said portion (34, 35) substantially vertically out of said cradle.
25
17. A yoke according to claim 15 or 16, characterized in that it, in addition to the portion (34, 35) carrying the coil (36, 37), comprises two yoke parts (38, 39; 40, 41), arranged on opposite sides of this portion (34, 35), forming said cradle and
30 having the surfaces (46, 47; 48, 49) which are adapted to abut against a respective magnetic core (25, 26; 27, 28).
18. A yoke according to any of claims 13-17, characterized in that it comprises at least one portion (42, 43; 44, 45) being
35 detachably connected to the rest of the yoke (32, 33) and ar-

ranged to be detached for access of parts of the device which are arranged vertically under the electromagnetic brake.

- 5 19. A yoke according to claim 18, characterized in that said portion (42, 43; 44, 45) is a peripheral portion of the yoke (32, 33) which is pivoted relative to the rest of the yoke (32, 33).

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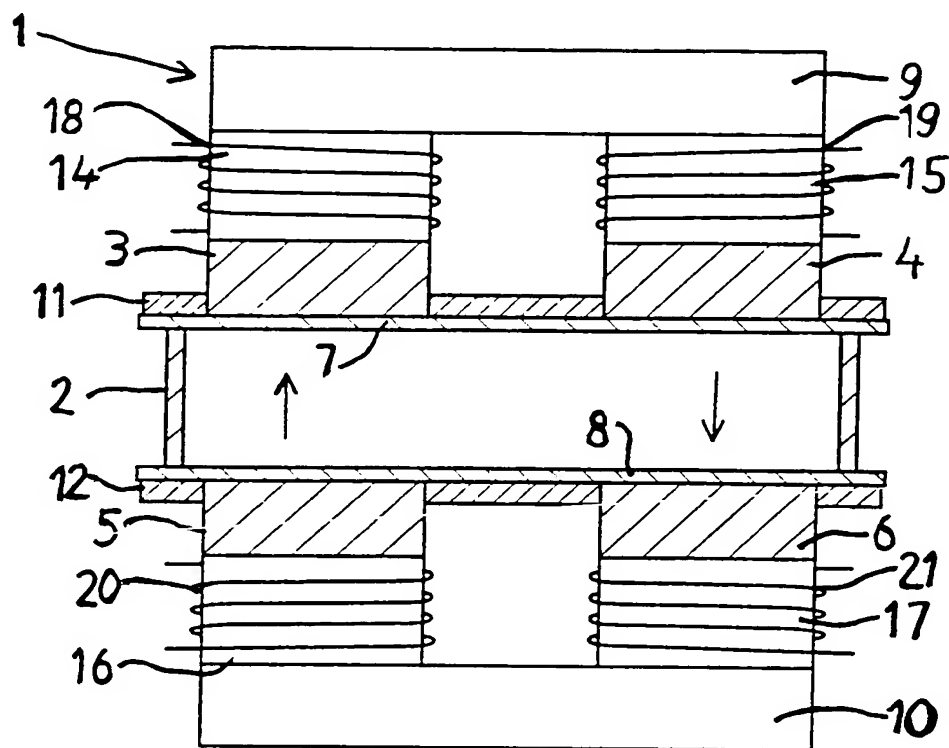


Fig 1

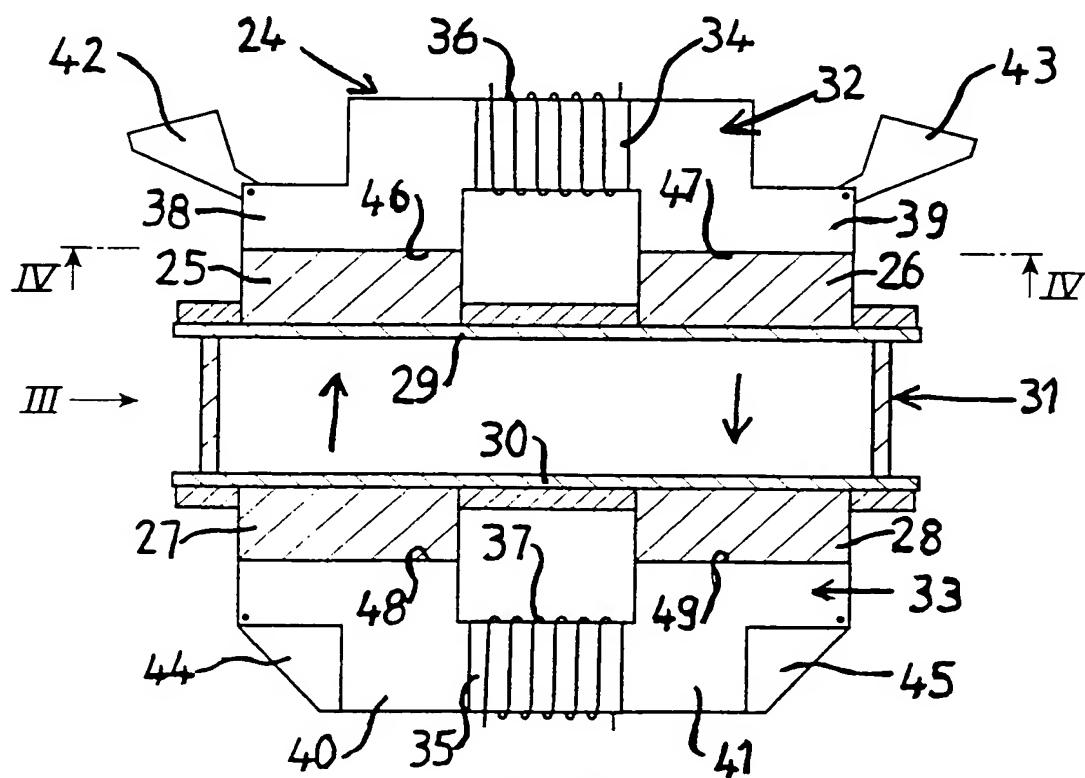


Fig 2

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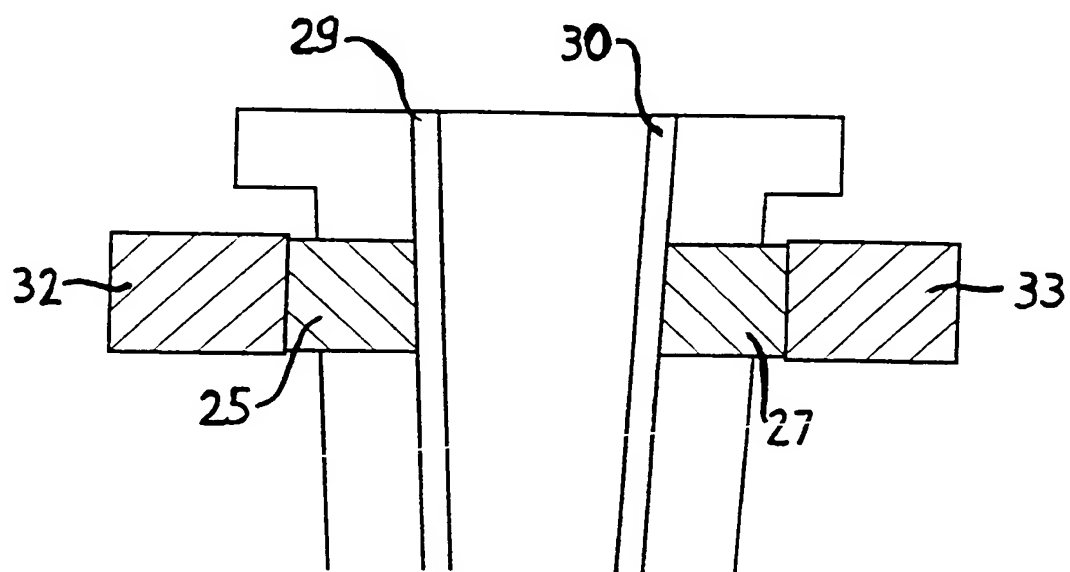


Fig 3

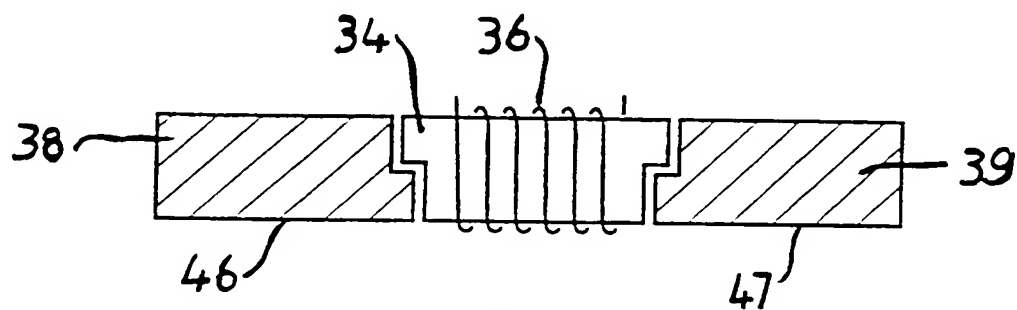


Fig 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01598

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B22D 11/115

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B22D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
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| A | JP 1271035 (NKK CORP) 1990-01-22 (abstract). (online) (retrieved 2000-12-19). Retrived from: EPO PAJ Database. -- | 1-19 |

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

| | |
|---|---|
| * Special categories of cited documents | F" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "A" document defining the general state of the art which is not considered to be of particular relevance | X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
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| "O" document referring to an oral disclosure, use, exhibition or other means | |
| "P" document published prior to the international filing date but later than the priority date claimed | |

| | |
|---|--|
| Date of the actual completion of the international search 19 December 2000 | Date of mailing of the international search report 21 -12- 2000 |
| Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86 | Authorized officer Ulf Nyström/ELY Telephone No. +46 8 782 25 00 |

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01598

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
| A | EP 0577831 A1 (NIPPON STEEL CORPORATION ET AL), 12 January 1994 (12.01.94), column 13, line 35 - line 51, figure 34 -- | 1-19 |
| A | EP 0165316 A1 (KAWASAKI STEEL CORPORATION), 27 December 1985 (27.12.85), page 6, line 4 - page 7, line 13, figures 4,5 -- ----- | 1-19 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application

PCT/SE 00/0159

| Patent document cited in search report | | | Publication date | Patent family member(s) | | Pub- d |
|---|---------|----|---------------------|----------------------------|--------------|-----------|
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| | | | | DE | 69131169 D,T | 09/12/99 |
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| | | | | JP | 2039281 C | 28/03/96 |
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| | | | | JP | 3258442 A | 18/11/91 |
| | | | | JP | 7087974 B | 27/09/95 |
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| EP | 0165316 | A1 | 27/12/85 | JP | 1514565 C | 24/08/89 |
| | | | | JP | 58215254 A | 14/12/83 |
| | | | | JP | 63063300 B | 07/12/88 |
| | | | | US | 4706735 A | 17/11/87 |
| | | | | WO | 8502569 A | 20/06/85 |

PATENT COOPERATION TREATY

PCT

RECD 25 JAN 2002

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference 20408PCTJD | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/SE00/.1598 | International filing date (day month year) 22.08.2000 | Priority date (day month year) 03.09.1999 |
| International Patent Classification (IPC) or national classification and IPC7 B 22 D 11/115 | | |
| Applicant ABB AB et al | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

**CORRECTED
VERSION**

| | |
|---|---|
| Date of submission of the demand 15.02.2002 | Date of completion of this report 17.01.2002 |
| Name and mailing address of the IPEA SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 8-667 70 88 | Authorized officer Ulf Nyström/ELY Telephone No. 08-782 25 00 |

Form PCT/IPEA 409 (cover sheet) (January 1998)

CORRECTED

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01598

I. Basis of the report

1. With regard to the **elements** of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
 pages 1-8 , as originally filed
 pages _____ , filed with the demand
 pages _____ , filed with the letter of _____
- ☒ the claims:
 pages _____ , as originally filed
 pages _____ , as amended (together with any statement) under article 19
 pages _____ , filed with the demand
 pages 10-13 , filed with the letter of 20.11.2001
- ☒ the drawings:
 pages 1-2 , as originally filed
 pages _____ , filed with the demand
 pages _____ , filed with the letter of _____
- ☐ the sequence listing part of the description:
 pages _____ , as originally filed
 pages _____ , filed with the demand
 pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01596

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|--------------------------|-----|
| Novelty (N) | Claims | <u>3, 8-12, 15-20</u> | YES |
| | Claims | <u>1, 2, 4-7, 13, 14</u> | NO |
| Inventive step (IS) | Claims | <u>8-12, 15-20</u> | YES |
| | Claims | <u>1-7, 13, 14</u> | NO |
| Industrial applicability (IA) | Claims | <u>1-20</u> | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

The present invention according to the amended claims of 2001-11-20 relates to an electromagnetic brake device for continuous casting.

The following documents are cited in the International Search Report:

- D1. JP 9057401 A
- D2. JP 1271035 A
- D3. EP 577331 A1
- D4. EP 165316 A1

Document D1 discloses an electromagnetic brake device for continuous casting comprising a coil wound around a yoke, which is detachably connected to the cores or poles with bolts for attaining maintenance or replacement of the coil. The coil is wound around the yoke such that the centre axis of the coil is parallel to a long side of the mould.

Document D2 discloses electromagnetic brake devices comprising electromagnets with coils arranged such that the axis of the coils are perpendicularly to the casting direction in the mould.

Documents D3 and D4 disclose the general state of the art concerning electromagnetic brake devices for continuous casting.

Accordingly, the electromagnetic brake according to claims 1, 2, 4 - 7 and the yoke according to claims 13 and 14 do not differ from the art disclosed in D1. Therefore, the subject matters according to these claims lack novelty.

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01598

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

It is considered obvious for a person skilled in the art to make the yokes and coils according to D2 detachable in the same manner as stated in D1. Therefore, the subject matter according to claim 3 lacks an inventive step.

The subject matter according to dependent claims 8-12 and 15-19 is considered to fulfil the requirement of novelty, inventive step and industrial applicability

The invention according to the independent claim 20 relating to a magnetic brake adaptable to different mould sizes is novel. The cited prior art does not give any indication that would lead a person skilled in the art to adapt a magnetic brake to different mould sizes by means of a detachable yoke between two magnetic cores. Accordingly, the invention defined in claim 20 is novel and is considered to involve an inventive step and comprise industrial applicability.

Claims

1. A device for continuous or semi-continuous casting of metals, comprising an electromagnetic brake which comprises
5
- at least two magnetic cores (25, 26; 27, 28), arranged on one side of a mould (31) and attached thereto, and
- a yoke (32, 33), which is detachably connected to the two magnetic cores (25, 26; 27, 28) and interconnects them,
10 characterized in that said yoke (32, 33) carries at least one coil (36, 37), substantially between the two magnetic cores (25, 26; 27, 28) interconnected by the yoke (32, 33).
2. A device according to claim 1, characterized in that the
15 mould (31) is rectangular transversal to the casting direction and has two opposite long sides (29, 30), along one of which the yoke (32, 33) extends substantially parallel thereto and that the coil (36, 37) is wound around the yoke (32, 33) such that the centre axis of the coil (36, 37) is sub-
20 stantially parallel to said long side (29, 30).
3. A device according to claim 2, characterized in that the
centre axis of the coil (36, 37) extends substantially perpen-
25 dicularly to the casting direction in the mould (31).
4. A device according to any of claims 1-3, characterized in
that the magnetic cores (25, 26, 27, 28) are permanently se-
cured to the mould (31).
- 30 5. A device according to any of claims 1-4, characterized in
that the magnetic cores (25-28) are arranged with a space
therebetween and that the coil (36, 37) is positioned substan-
tially right in front of said space.
- 35 6. A device according to any of claims 1-5, characterized in
that the yoke (32, 33) substantially defines a bar or plate, and

that the coil (36, 37) is wound around a centre portion (34, 35) of the bar or plate.

- 5 7. A device according to any of claims 1-6, characterized in that the magnetic cores (25, 26; 27, 28) cover substantially the entire width of the mould (31), except for a centre portion of the mould (31).
- 10 8. A device according to any of claims 1-7, characterized in that the yoke (32, 33) comprises a portion (34, 35) which is detachable from the rest of the yoke (32, 33) and carries the coil (36, 37).
- 15 9. A device according to claim 8, characterized in that the yoke (32, 33) defines a cradle arranged to receive the portion (34, 35) carrying the coil (36, 37) and allow displacement of said portion (34, 35) substantially vertically out of said cradle.
- 20 10. A device according to claim 9, characterized in that the yoke (32, 33), in addition to said portion (34, 35) carrying the coil (36, 37), comprises two yoke parts (38, 39; 40, 41), arranged on opposite sides of this portion (34, 35), forming said cradle and each having a surface (46, 47; 48, 49) adapted to abut against a respective magnetic core (25, 26; 27, 28).
- 25 11. A device according to any of claims 1-10, characterized in that the yoke (32, 33) comprises at least one portion (42-45) being detachably connected to the rest of the yoke (32, 33) and arranged to be detached for access of parts of the device which are arranged vertically under the electromagnetic brake.
- 30 12. A device according to claim 11, characterized in that said portion (42-45) is a peripheral portion of the yoke (32, 33) being pivoted relative to the rest of the yoke (32, 33).
- 35

13. A yoke for an electromagnetic brake (24) of a device for continuous or semi-continuous casting of metals, comprising two separate surfaces adapted to detachably abut against one magnetic core (25, 26; 27, 28) each of two magnetic
5 cores (25, 26; 27, 28) arranged on one side of a mould (31), characterized in that it carries a coil (36, 37) being wound around the yoke (32, 33) substantially between said surfaces (46, 47; 48, 49).
- 10 14. A yoke according to claim 13, characterized in that it is elongated, that said surfaces (46, 47; 48, 49) extend substantially in parallel with its longitudinal direction and that the coil (36, 37) is wound transversal to said longitudinal direction such that its centre axis is substantially parallel to the
15 longitudinal direction.
15. A yoke according to claim 13 or 14, characterized in that it comprises a portion (42, 43; 44, 45) which is detachable from the rest of the yoke and carries the coil (36, 37).
20
16. A yoke according to claim 15, characterized in that it defines a cradle arranged to receive the portion (34, 35) carrying the coil (36, 37) and allow displacement of said portion (34, 35) substantially vertically out of said cradle.
25
17. A yoke according to claim 15 or 16, characterized in that it, in addition to the portion (34, 35) carrying the coil (36, 37), comprises two yoke parts (38, 39; 40, 41), arranged on opposite sides of this portion (34, 35), forming said cradle and
30 having the surfaces (46, 47; 48, 49) which are adapted to abut against a respective magnetic core (25, 26; 27, 28).
18. A yoke according to any of claims 13-17, characterized in that it comprises at least one portion (42, 43; 44, 45) being
35 detachably connected to the rest of the yoke (32, 33) and ar-

ranged to be detached for access of parts of the device which are arranged vertically under the electromagnetic brake.

- 5 19. A yoke according to claim 18, characterized in that said portion (42, 43; 44, 45) is a peripheral portion of the yoke (32, 33) which is pivoted relative to the rest of the yoke (32, 33).

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|--|---|
| Date of mailing (day/month/year) 08 May 2001 (08.05.01) | |
| International application No. PCT/SE00/01598 | Applicant's or agent's file reference 20408PCT JO |
| International filing date (day/month/year) 22 August 2000 (22.08.00) | Priority date (day/month/year) 03 September 1999 (03.09.99) |
| Applicant SVAHN, Conny et al | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
15 February 2001 (15.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer Claudio Borton Telephone No.: (41-22) 338.83.38 |
|---|--|

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PATENT COOPERATION TREATY

PCT

REC'D 18 JAN 2002

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

12

| | | |
|--|---|--|
| Applicant's or agent's file reference 20408PCTJO | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/SE00/01598 | International filing date (day/month/year) 22.08.2000 | Priority date (day/month/year) 03.09.1999 |
| International Patent Classification (IPC) or national classification and IPC7 B 22 D 11/115 | | |
| Applicant ABB AB et al | | |

| |
|---|
| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>4</u> sheets.</p> |
| <p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p> |

| | |
|--|---|
| Date of submission of the demand 15.02.2001 | Date of completion of this report 20.12.2001 |
| Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88 | Authorized officer Ulf Nyström/ELY Telephone No. 08-782 25 00 |

Form PCT/IPEA/409 (cover sheet) (January 1998)

I. Basis of the report

1. With regard to the **elements** of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
pages 1-8 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____
- ☒ the claims:
pages _____ , as originally filed
pages _____ , as amended (together with any statement) under article 19
pages _____ , filed with the demand
pages 10-13 , filed with the letter of 20.11.2001
- ☒ the drawings
pages 1-2 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

V: Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

| | | | |
|-------------------------------|--------|--------------------------|-----|
| Novelty (N) | Claims | <u>3, 8-12, 15, 20</u> | YES |
| | Claims | <u>1, 2, 4-7, 13, 14</u> | NO |
| Inventive step (IS) | Claims | <u>8-12, 15, 20</u> | YES |
| | Claims | <u>1-7, 13, 14</u> | NO |
| Industrial applicability (IA) | Claims | <u>1-20</u> | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

The present invention according to the amended claims of 2001-11-20 relates to an electromagnetic brake device for continuous casting.

The following documents are cited in the International Search Report:

D1. JP 9057401 A
D2. JP 1271035 A
D3. EP 577831 A1
D4. EP 165316 A1

Document D1 discloses an electromagnetic brake device for continuous casting comprising a coil wound around a yoke, which is detachably connected to the cores or poles with bolts for attaining maintenance or replacement of the coil. The coil is wound around the yoke such that the centre axis of the coil is parallel to a long side of the mould.

Document D2 discloses electromagnetic brake devices comprising electromagnets with coils arranged such that the axis of the coils are perpendicularly to the casting direction in the mould.

Documents D3 and D4 disclose the general state of the art concerning electromagnetic brake devices for continuous casting.

Accordingly, the electromagnetic brake according to claims 1, 2, 4 - 7 and the yoke according to claims 13 and 14 do not differ from the art disclosed in D1. Therefore, the subject matters according to these claims lack novelty.

.../...

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

It is considered obvious for a person skilled in the art to make the yokes and coils according to D2 detachable in the same manner as stated in D1. Therefore, the subject matter according to claim 3 lacks an inventive step.

The subject matter according to dependent claims 8-12 and 15-19 is considered to fulfil the requirement of novelty, inventive step and industrial applicability

The invention according to the independent claim 20 relating to a magnetic brake adaptable to different mould sizes is novel. The cited prior art does not give any indication that would lead a person skilled in the art to adapt a magnetic brake to different mould sizes by means of a detachable yoke between two magnetic cores. Accordingly, the invention defined in claim 20 is novel and is considered to involve an inventive step and comprise industrial applicability.

Claims

1. A device for continuous or semi-continuous casting of metals, comprising an electromagnetic brake which comprises
 - at least two magnetic cores (25, 26; 27, 28), arranged on one side of a mould (31) and attached thereto, and
 - a yoke (32, 33), which is detachably connected to the two magnetic cores (25, 26; 27, 28) and interconnects them, characterized in that said yoke (32, 33) carries at least one coil (36, 37), substantially between the two magnetic cores (25, 26; 27, 28) interconnected by the yoke (32, 33).
2. A device according to claim 1, characterized in that the mould (31) is rectangular transversal to the casting direction and has two opposite long sides (29, 30), along one of which the yoke (32, 33) extends substantially parallel thereto and that the coil (36, 37) is wound around the yoke (32, 33) such that the centre axis of the coil (36, 37) is substantially parallel to said long side (29, 30).
3. A device according to claim 2, characterized in that the centre axis of the coil (36, 37) extends substantially perpendicularly to the casting direction in the mould (31).
4. A device according to any of claims 1-3, characterized in that the magnetic cores (25, 26, 27, 28) are permanently secured to the mould (31).
5. A device according to any of claims 1-4, characterized in that the magnetic cores (25-28) are arranged with a space therebetween and that the coil (36, 37) is positioned substantially right in front of said space.
6. A device according to any of claims 1-5, characterized in that the yoke (32, 33) substantially defines a bar or plate, and

that the coil (36, 37) is wound around a centre portion (34, 35) of the bar or plate.

- 5 7. A device according to any of claims 1-6, characterized in that the magnetic cores (25, 26; 27, 28) cover substantially the entire width of the mould (31), except for a centre portion of the mould (31).
- 10 8. A device according to any of claims 1-7, characterized in that the yoke (32, 33) comprises a portion (34, 35) which is detachable from the rest of the yoke (32, 33) and carries the coil (36, 37).
- 15 9. A device according to claim 8, characterized in that the yoke (32, 33) defines a cradle arranged to receive the portion (34, 35) carrying the coil (36, 37) and allow displacement of said portion (34, 35) substantially vertically out of said cradle.
- 20 10. A device according to claim 9, characterized in that the yoke (32, 33), in addition to said portion (34, 35) carrying the coil (36, 37), comprises two yoke parts (38, 39; 40, 41), arranged on opposite sides of this portion (34, 35), forming said cradle and each having a surface (46, 47; 48, 49) adapted to abut against a respective magnetic core (25, 26; 27, 28).
- 25 11. A device according to any of claims 1-10, characterized in that the yoke (32, 33) comprises at least one portion (42-45) being detachably connected to the rest of the yoke (32, 33) and arranged to be detached for access of parts of the device which are arranged vertically under the electromagnetic
- 30 brake.
- 35 12. A device according to claim 11, characterized in that said portion (42-45) is a peripheral portion of the yoke (32, 33) being pivoted relative to the rest of the yoke (32, 33).

13. A yoke for an electromagnetic brake (24) of a device for continuous or semi-continuous casting of metals, comprising two separate surfaces adapted to detachably abut against one magnetic core (25, 26; 27, 28) each of two magnetic cores (25, 26; 27, 28) arranged on one side of a mould (31),
5 characterized in that it carries a coil (36, 37) being wound around the yoke (32, 33) substantially between said surfaces (46, 47; 48, 49).
- 10 14. A yoke according to claim 13, characterized in that it is elongated, that said surfaces (46, 47; 48, 49) extend substantially in parallel with its longitudinal direction and that the coil (36, 37) is wound transversal to said longitudinal direction such that its centre axis is substantially parallel to the
15 longitudinal direction.
15. A yoke according to claim 13 or 14, characterized in that it comprises a portion (42, 43; 44, 45) which is detachable from the rest of the yoke and carries the coil (36, 37).
20
16. A yoke according to claim 15, characterized in that it defines a cradle arranged to receive the portion (34, 35) carrying the coil (36, 37) and allow displacement of said portion (34, 35) substantially vertically out of said cradle.
25
17. A yoke according to claim 15 or 16, characterized in that it, in addition to the portion (34, 35) carrying the coil (36, 37), comprises two yoke parts (38, 39; 40, 41), arranged on opposite sides of this portion (34, 35), forming said cradle and
30 having the surfaces (46, 47; 48, 49) which are adapted to abut against a respective magnetic core (25, 26; 27, 28).
18. A yoke according to any of claims 13-17, characterized in that it comprises at least one portion (42, 43; 44, 45) being
35 detachably connected to the rest of the yoke (32, 33) and ar-

ranged to be detached for access of parts of the device which are arranged vertically under the electromagnetic brake.

- 5 19. A yoke according to claim 18, characterized in that said portion (42, 43; 44, 45) is a peripheral portion of the yoke (32, 33) which is pivoted relative to the rest of the yoke (32, 33).
- 10 20. A device for continuous or semi-continuous casting of metals, comprising an electromagnetic brake which comprises
- at least two magnetic cores (25, 26; 27, 28), arranged on one side of a mould (31) and attached thereto, and
 - a yoke (32, 33), which is detachably connected to the two
- 15 magnetic cores (25, 26; 27, 28) and interconnects them, said yoke (32, 33) carrying at least one coil (36, 37), substantially between the two magnetic cores (25, 26; 27, 28) interconnected by the yoke (32, 33), characterized in
- 20 such that the centre axis of the coil (36, 37) is wound around the yoke (32, 33) such that the centre axis of the coil (36, 37) is substantially parallel to one long side (29, 30) of the mould (31), that the centre axis of the coil (36, 37) extends substantially perpen-
- 25 dicularly to the casting direction in the mould (31) and that the magnetic cores (25, 26; 27, 28) cover substantially the entire width of the mould (31), except for a centre portion of the mould (31).

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

| | |
|---|------------------------|
| For receiving Office use only | |
| International Application No. | PCT/SE 0 0 / 0 1 5 9 8 |
| International Filing Date | 2 2 -08- 2000 |
| The Swedish Patent Office PCT International Application | |
| Name of receiving Office and "PCT International Application" | |
| Applicant's or agent's file reference (if desired) (12 characters maximum) 20408PCT JO | |

| | |
|---|---|
| Box No. I TITLE OF INVENTION | |
| "A device for continuous or semi-continuous casting of metals" | |
| Box No. II APPLICANT | |
| Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) | |
| ABB AB SE-721 83 VÄSTERÅS Sweden | <input type="checkbox"/> This person is also inventor. Telephone No. Facsimile No. Teleprinter No. |
| State (that is, country) of nationality: Sweden | State (that is, country) of residence: Sweden |
| This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input checked="" type="checkbox"/> all designated States except the United States of America <input type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box | |
| Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S) | |
| Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) | |
| SVAHN Conny Rekylgatan 10 SE-723 38 VÄSTERÅS Sweden | This person is: <input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.) |
| State (that is, country) of nationality: Sweden | State (that is, country) of residence: Sweden |
| This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box | |
| <input checked="" type="checkbox"/> Further applicants and/or (further) inventors are indicated on a continuation sheet. | |
| Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE | |
| The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: <input checked="" type="checkbox"/> agent <input type="checkbox"/> common representative | |
| Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) | |
| BJERKÉNS PATENTBYRÅ KB, represented by OLSSON Jan; BERGLUND Stefan; ISRAELSSON Stefan; LÖFGREN Jonas or BJERKÉN Håkan Box 1274 SE-801 37 GÄVLE SWEDEN | Telephone No. Int + 46 26 10 05 50 Facsimile No. Int + 46 26 14 30 45 Teleprinter No. |
| <input type="checkbox"/> Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent. | |

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

KROON Tord
Dybecksgatan 22E
SE-722 22 VÄSTERÅS
Sweden

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

Sweden

State (that is, country) of residence:

Sweden

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
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The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked).

Regional Patent

- ☒ AP **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

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| <input checked="" type="checkbox"/> AG Antigua and Barbuda | <input checked="" type="checkbox"/> LK Sri Lanka |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LR Liberia |
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| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MN Mongolia |
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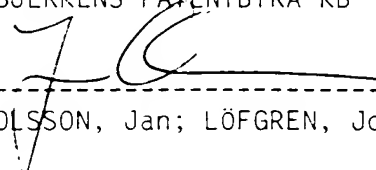
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| item (1) 03.09.1999 | 9903146-0 | Sweden | | |
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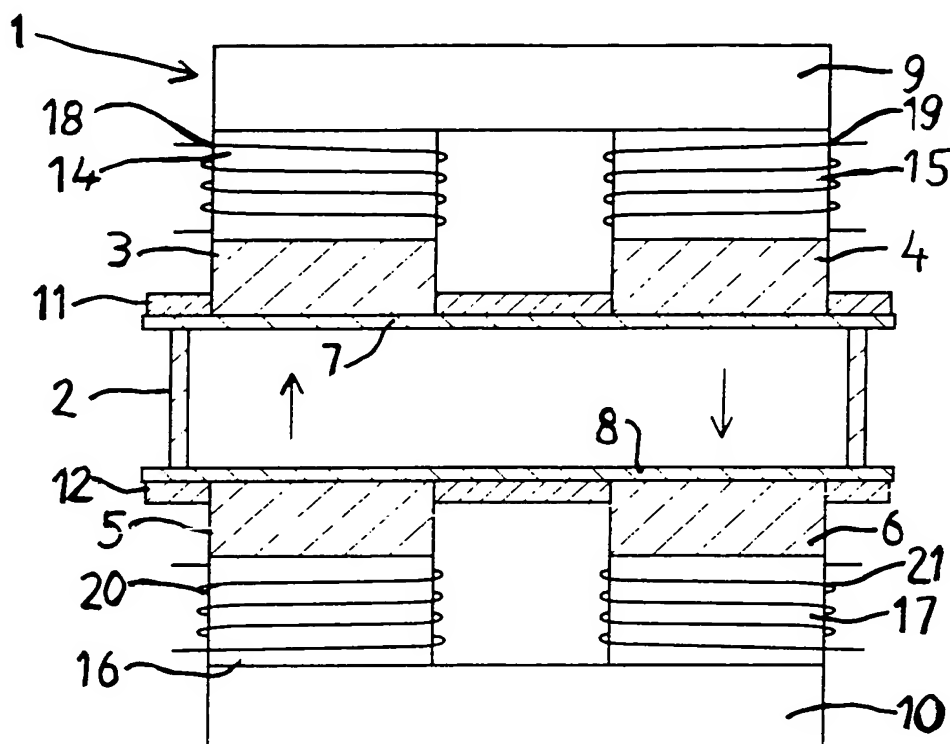


Fig 1

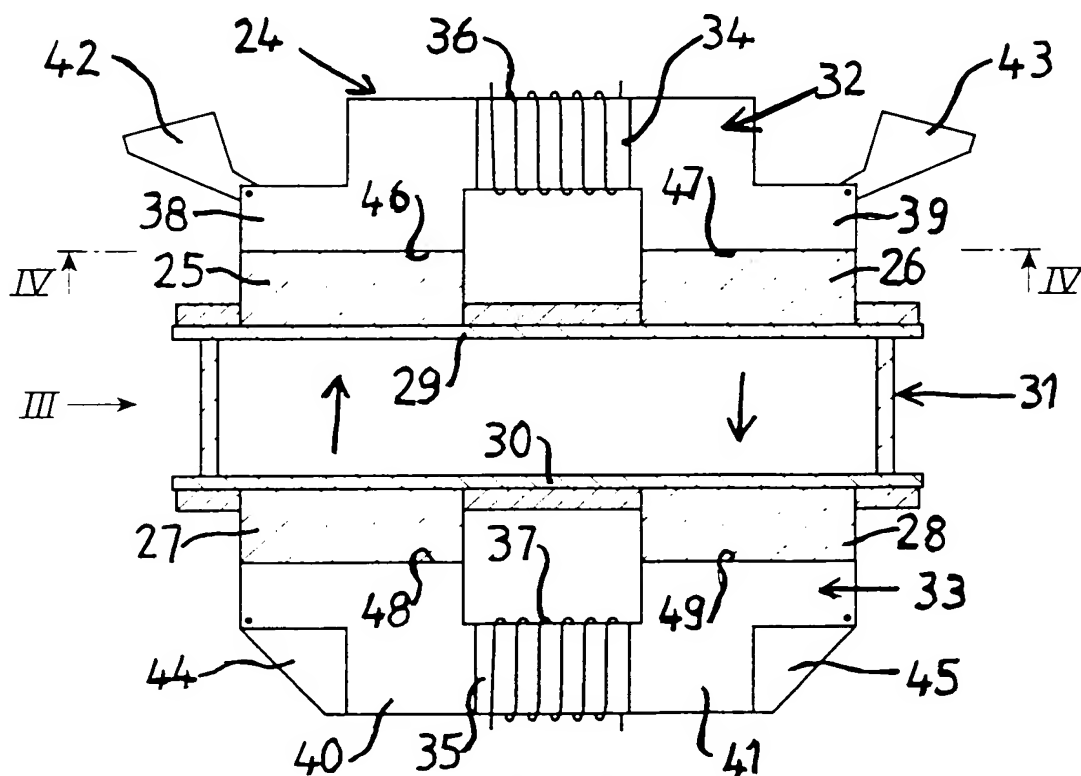


Fig 2

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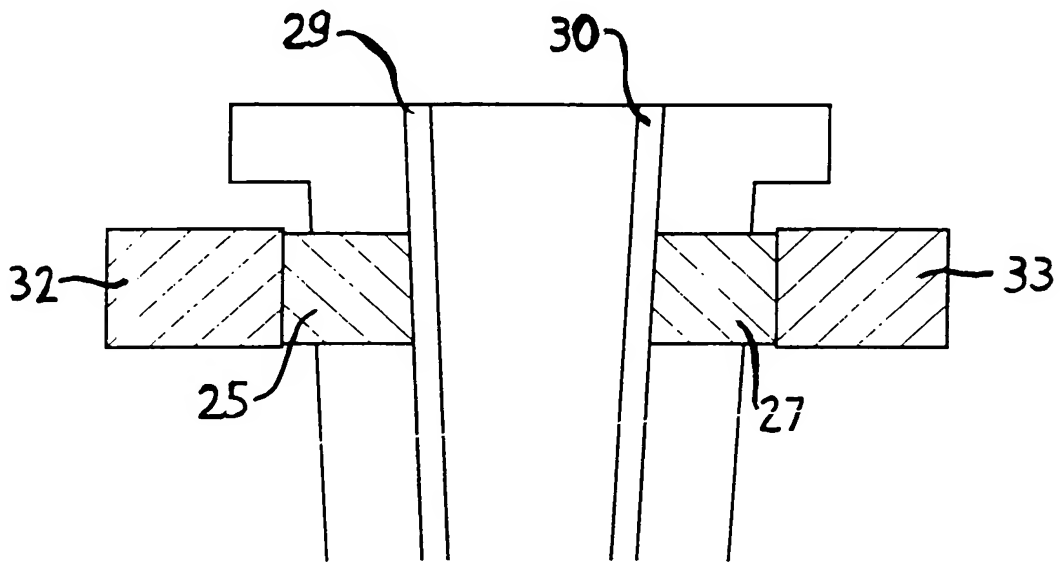


Fig 3

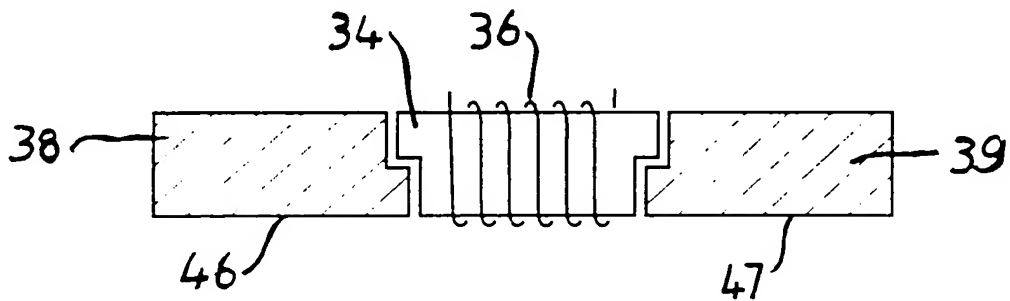


Fig 4

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ANORDNING FÖR KONTINUERLIG ELLER HALVKONTINUERLIG GJUTNING AV METALLER

UPPFINNINGENS OMRÅDE

10

Föreliggande uppfinning avser en anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller. Den innefattar i synnerhet en elektromagnetisk broms som innefattar åtminstone två magnetkärnor anordnade på en sida om och fästade vid en kokill, och ett ok som är lösgörbart förbundet med och förbinder de två magnetkärnorna.

15

20

25

Elektromagnetiska bromsar innefattar inrättningar för generering av ett statiskt, likströmsmatat magnetfält eller permanentmagnetmatat eller växlande, lågfrekvent pulserande magnetfält i smältan i en kokill i en anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller. När inströmmande metall passerar fältet, bromsar fältet tappstrålens rörelse in i den övriga smältan och tappstrålen splittras så att dess impuls försvagas eller upphör. Huvudprinciperna för funktionen och fördelarna med sådana elektromagnetiska bromsar är sedan tidigare välkända.

30

Uppfinningens område inbegriper i synnerhet anordningar för gjutning av "slabs", där kokillen har ett rektangulärt tvärsnitt och motsatta par av magnetkärnor är anordnade utmed kokillens motsatta långsidor och förbundna med var sitt ok.

UPPFINNINGENS BAKGRUND OCH TIDIGARE TEKNIK

35

Enligt tidigare teknik är det känt att anordna elektromagnetiska bromsar av det inledningsvis definierade slaget, hos vilka varje magnetkärna är uppdelad i en främre del som är permanent an-

magnetkärna är uppdelad i en främre del som är permanent anordnad vid kokillen och en bakre del som är lösgörbart förbunden med den främre delen. Varje bakre kärndel bär en spole och var och en av spolarna är lindad väsentligen parallellt med kokillväggen kring den bakre magnetkärndelen. Magnetkärnans främre del kan ha formen av en platta eller liknande som innefattar ett magnetiskt material och är permanent förbunden med kokillen. Den bakre delen uppvisar en yta för anliggning mot den främre delen som har en area och en geometri som är anpassad till arean och geometrin hos den främre delen som i sin tur är beroende av bland annat av kokillens storlek.

En nackdel hos anordningar enligt tidigare teknik är att de fordrar individuell anpassning av den magnetkärndel som spolarna är lindade kring för olika kokiller av olika storlek och formen och storleken på de magnetkärnor som används skiljer sig från fall till fall.

Magnetkärnor enligt tidigare teknik tar dessutom upp relativt stort utrymme i en riktning vinkelrätt ut från kokillväggen.

SYFTET MED UPPFINNINGEN

Ett syfte med den föreliggande uppfinningen är att tillhandahålla en anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller som innefattar en elektromagnetisk broms som är utformad så att den enkelt kan anpassas till olika kokillstorlekar. Oket och magnetkärnorna skall dessutom vara anordnade på ett sådant sätt att en kompakt broms, som skjuter ut så litet som möjligt från kokillväggen, uppnås, för att möjliggöra åtkomst av under bromsen belägna anordningar, till exempel lyftanordningar.

Åtminstone en del av oket skall dessutom vara enkelt att montera och demontera från de vid kokillen anordnade magnetkärnorna.

SAMMANFATTNING AV UPPFINNINGEN

Syftet med uppfinningen uppnås med hjälp av en anordning av det inledningsvis definierade slaget, vilken är kännetecknad av att oket bär en spole och att spolen är lindad kring oket väsentli-
5 gen mellan de bägge magnetkärnor som oket förbinder. Placer-
ingen av spolen på oket resulterar i att några magnetkärndelar inte behöver bära någon spole och vara begränsade av spolen på samma sätt som hos anordningar enligt tidigare teknik. De
10 kan enkelt förlängas eller avkortas i okets längdriktning, det vill säga utmed kokillens bredd.

Kokillen är företrädesvis rektangulär tvärs gjutriktningen och har två motsatta långsidor, utmed en av vilka oket sträcker sig vä-
15 sentligen parallellt, och spolen är företrädesvis lindad kring oket så att spolens centrumaxel är väsentligen parallell med nämnda långsida och sträcker sig vinkelrätt mot gjutriktningen i kokillen. Ett sådant anordnande är fördelaktigt ur utrymmessynpunkt och medför dessutom att spolen, eller den del av oket som spolen är
20 lindad kring, kan göras enkelt åtkomlig och utbytbar men kan även ge tillträde till under bromsen placerade anordningar, till exempel lyftanordningar. Företrädesvis är magnetkärnorna an-
ordnade med ett mellanrum mellan sig, varvid spolen är positio-
nerad väsentligen mitt för nämnda mellanrum. Spolen kan med
25 fördel tillåtas skjuta in i nämnda mellanrum i syfte att spara utrymme.

Enligt ett föredraget utförande av anordningen innefattar oket ett från resten av oket lösgörbart anordnat parti, vilket parti bär
30 spolen. Företrädesvis innefattar oket två på motsatta sidor om nämnda parti anordnade okdelar, vilka bildar en vagga som nämnda okparti kan vila i och vilka uppvisar var sin yta som är ägnad att anligga mot en respektive magnetkärna. Den vagga som nämnda okdelar definierar är företrädesvis inrättad att tillåta
35 en förskjutning av det spolbärande partiet väsentligen vertikalt ur nämnda vagga i syfte att underlätta utbyte och underhåll av spolen eller delar av anordningen som är lokaliserade vertikalt under

spolen och som annars skulle vara svåra att komma åt. De okdelar som är anordnade på motsatta sidor om det spolbärande okpartiet kan enkelt anpassas till olika kokillbredder, eller närmare bestämt magnetkärnbredder, genom anpassning av deras
5 längd.

Ett ytterligare syfte med uppfinningen är att tillhandahålla ett ok som är så konstruerat att den elektromagnetiska bromsen enkelt kan anpassas till olika kokillbredder utan att den eller de spolar
10 som är anordnade på bromsen utgör något betydande hinder för en sådan anpassning. Oket skall dessutom vara utformat enligt en princip som gynnar en föga utrymmeskrävande konstruktion av den elektromagnetiska broms som oket bildar en del av.

15 Detta syfte uppnås medelst ett ok enligt ingressen till patentkravet 13, vilket är kännetecknat av att det bär en spole som är lindad kring oket väsentligen mellan nämnda ytor. Nämnda ytor är två åtskilda ytor hos oket som är ägnade att lösgörbart anligga mot var sin magnetkärna hos två vid en kokill anordnade magnetkärnor.
20 Oket är för övrigt företrädesvis anordnat och utformat på det vis som beskrivits ovan med hänvisning till den uppfinningsenliga anordningen.

Ytterligare fördelar med och särdrag hos anordningen och oket
25 enligt uppfinningen kommer att framgå av den följande beskrivningen samt av de bifogade patentkraven.

KORT BESKRIVNING AV RITNINGARNA

30 Ett föredraget utföringsexempel av anordningen enligt uppfinningen skall härafter i exemplifierande syfte beskrivas mer i detalj med hänvisning till den bifogade ritningen, på vilken:

- 35 fig. 1 är en schematisk vy ovanifrån av en anordning enligt tidigare teknik,
fig. 2 är en schematisk, skuren vy ovanifrån av anordningen enligt uppfinningen,

fig. 3 är en schematisk, skuren vy enligt III-III i fig. 2, och
fig. 4 är en schematisk, skuren vy enligt IV-IV i fig. 2.

5 DETALJERAD BESKRIVNING AV ETT FÖREDRAGET UTFÖRINGSEXEMPEL

Fig. 1 visar en anordning enligt tidigare teknik för kontinuerlig eller halvkontinuerlig gjutning av metaller, varvid anordningen innefattar en elektromagnetisk broms 1. Anordningen innefattar
10 dessutom en kopparkokill 2 av i sig känt slag på motsatta sidor om vilken den elektromagnetiska bromsen 1 är anordnad. Den elektromagnetiska bromsen 1 innefattar ett antal magnetkärnor 3, 4, 5, 6 som är förbundna med kokillväggen. Magnetkärnorna 3-6 är anordnade parvis på motsatta sidor om kokillen utmed dennas
15 långsidor 7, 8 och täcker väsentligen hela kokillens bredd förutom ett centrumparti av kokillen. Varje magnetkärnpars magnetkärnor 3, 4 respektive 5, 6 är förbundna medelst ett ok 9, 10.

Magnetkärnorna 3, 4 respektive 5, 6 är insvetsade i fönster i s.k.
20 backup-plattor 11, 12 som är gjorda av rostfritt stål och bildar stödväggar åt kokillens kopparplåtar.

Varje magnetkärna 3-6 innefattar en magnetkärndel 14-17 som bär en spole 18-21. De spolbärande magnetkärndelarna 14-17 är
25 företrädesvis lösgörbart förbundna med främre magnetkärndelar, vilka är insvetsade i fönstren i backup-plattorna 11, 12. Oken 9, 10 är lösgörbart förbundna, till exempel fastbultade, vid magnetkärnorna 3, 4 respektive 5, 6. Spolarna 18, 19, 20, 21 är lindade väsentligen parallellt med kokillväggen runt de bakre magnetkärndelarna 14, 15 respektive 16, 17.
30

Då en ström leds genom spolarna 18, 19, 20, 21 erhålls ett magnetfält med en riktning som är antydd genom pilarna i fig. 1.

35 Fig. 2-4 visar ett utföringsexempel av anordningen enligt uppfinningen, vilken visar en förbättrad vidareutveckling av anordningen enligt fig. 1. Liksom hos anordningen enligt fig. 1 innefattar

anordningen enligt uppfinningen en elektromagnetisk broms 24, vilken innefattar två par magnetkärnor 25, 26 respektive 27, 28 anordnade utmed motsatta långsidoväggar 29, 30 hos en kopparkokill 31 av i sig känt slag. Magnetkärnorna 25-28 är anordnade på motsvarande sätt som i fig. 1 och har som uppgift att bidra till en generering av ett magnetfält likt det som beskrivits för anordningen enligt fig. 1. Emellertid är inte magnetkärnorna uppdelade i främre och bakre delar, där de bakre delarna bär spolar, såsom fallet är i fig. 1.

Varje magnetkärnpars magnetkärnor 25, 26 respektive 27, 28 är förbundna medelst ett ok 32, 33. Varje ok 32, 33 innefattar ett parti 34, 35, på vilket en spole 36, 37 är lindad, varvid varje sådant parti är positionerat väsentligen mitt för ett mellanrum mellan de två magnetkärnor 25, 26 respektive 27, 28 som oken 36, 37 förbinder. Oken är lösgörbart förbundna med magnetkärnorna.

På motsatta sidor om det spolbärande partiet 34, 35 innefattar oken 32, 33 två ytterligare delar 38, 39 respektive 40, 41, vilka bildar en vagga åt det spolbärande partiet 34, 35 och vilka uppvisar ytor 46-49 för anliggning mot de respektive magnetkärnorna 25-28. De spolbärande partierna 34, 35 är lösgörbart fästade, här ovanifrån bultade, mot de ytterligare delarna 38, 39 respektive 40, 41. Den vagga som de ytterligare delarna 38, 39 och 40, 41 definierar är sådan att den tillåter förskjutning av de spolbärande partierna 34, 35 väsentligen vertikalt uppåt. På så vis kan spolarna 36, 37 enkelt demonteras och bytas ut om så fordras. De spolbärande partierna 34, 35 kan ha formen av en cirkulär eller fyrkantig stång av magnetiskt material, kring vilken spolarna 36, 37 är lindade.

Oken 32, 33 innefattar dessutom ett antal svängbart anordnade partier 42-45, vilka här är anordnade att svängas väsentligen horisontellt för att möjliggöra åtkomst av delar hos anordningen som är belägna under den elektromagnetiska bromsen 24 och kan behöva kommas åt för utbyte och underhåll. De svängbart anordnade delarna 42-45 bildar del av de ovan beskrivna delarna

38-41 som är anordnade på motsatta sidor om och förbundna med de spolbärande partierna 34, 35.

5 Typiska delar som ingår in anordningen och som är belägna under den elektromagnetiska bromsen 24 och måste göras åtkomliga är till exempel lyftanordningar för lyftning av kokillen med underliggande segment, och delar som fordrar utbyte och underhåll, till exempel rullar som används för styrning av den metallsträng som kontinuerligt gjuts medelst anordningen.

10 Oken 32, 33 skulle kunna innefatta ytterligare delar eller partier, men den föreslagna lösningen är tillräcklig för att möjliggöra en snabb och enkel anpassning av okstorleken till olika kokillbredder, det vill säga magnetkärnbredder. Lämpligtvis har de spolbärande partierna 34, 35 en standardstorlek och anpassas längden hos de ytterligare delarna 38-41 med hänsyn till kokillbredden/magnetkärnbredden.

20 Det skall inses att den uppfinningsenliga anordningen normalt innefattar ett stort antal ytterligare komponenter som emellertid av tydlighetsskäl inte visats i de bifogade ritningarna. Exempel på sådana komponenter är kylslingor anordnade kring kokillen, liksom olika komponenter som är anordnade runt omkring den elektromagnetiska bromsen och som begränsar det utrymme som den elektromagnetiska bromsen kan tillåtas uppta. En tanke med
25 uppfinningen är att ok av det uppfinningsenliga slaget skall kunna levereras till och monteras på redan befintliga anordningar för kontinuerlig eller halvkontinuerlig gjutning av metaller utan att någon komplicerad anpassning av bromsen som oket bildar del
30 av fordras vid varje enskilt tillfälle.

Oken 32, 33 har företrädesvis formen av stänger eller plattor. De spolbärande partierna 34, 35 kan levereras separat till en användare av en anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller, som sedan själv enkelt utifrån ett lämpligt
35 stångmaterial kapar och formar de ytterligare delarna 38-41.

Oken 32, 33, magnetkärnorna 25-28 och spolarna 36, 37 är in-
rättade att generera ett statiskt, likströmsmatat magnetfält eller
permanentmagnetmatat eller växlande, lågfrekvent pulserande
magnetfält i smältan i anordningens kokill.

5

Ett flertal varianter och alternativa utföranden av den uppfin-
ningsenliga anordningen kommer naturligtvis att vara uppenbara
för en fackman inomområdet utan att denne därvid frångår upp-
finningens ram, såsom denna är definierade i de bifogade kraven

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med stöd av beskrivningen och ritningarna.

Exempelvis kan de ytterligare, sidobelägna okdelarna 38-41 lika
väl betraktas som bakre magnetkärndelar som är lösgörbart för-
bundna med de främre magnetkärndelar, här kärnorna 25-28,
som är permanent fästade vid kokillen. Det är dock viktigt att
notera att förekommande spolar 36, 37 enbart är monterade på
okdelar, vilkas storlek och form, åtminstone över det tvärsnitt
där spolen är anordnad, är väsentligen oberoende av kokillstor-
leken och magnetkärnornas area mot kokillens kopparvägg.

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Ok och magnetkärnor är samtliga gjorda av ett magnetiskt mate-
rial, företrädesvis järn.

Patentkrav

1. Anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller, innefattande en elektromagnetisk broms som innefattar
5 - åtminstone två magnetkärnor (25, 26; 27, 28), anordnade på en sida om och fästade vid en kokill (31), och
- ett ok (32, 33), som är lösgörbart förbundet med och förbinder de två magnetkärnorna (25, 26; 27, 28), kännetecknad av att nämnda ok (32, 33) bär åtminstone en spole (36, 37), väsentligen
10 mellan de bägge magnetkärnor (25, 26; 27, 28) som oket (32, 33) förbinder.
2. Anordning enligt krav 1, kännetecknad av att kokillen (31) är rektangulär tvärs gjutriktningen och har två motsatta långsidor
15 (29, 30), utmed en av vilka oket (32, 33) sträcker sig väsentligen parallellt och att spolen (36, 37) är lindad kring oket (32, 33) så att spolens (36, 37) centrumaxel är väsentligen parallell med nämnda långsida (29, 30).
- 20 3. Anordning enligt krav 2, kännetecknad av att spolens (36, 37) centrumaxel sträcker sig väsentligen vinkelrätt mot gjutriktningen i kokillen (31).
4. Anordning enligt något av kraven 1-3, kännetecknad av att
25 magnetkärnorna (25, 26, 27, 28) är permanent fast förbundna med kokillen (31).
5. Anordning enligt något av kraven 1-4, kännetecknad av att magnetkärnorna (25-28) är anordnade med ett mellanrum mellan
30 sig och att spolen (36, 37) är positionerad väsentligen mitt för nämnda mellanrum.
6. Anordning enligt något av kraven 1-5, kännetecknad av att oket (32, 33) väsentligen definierar en stång eller platta, och att
35 spolen (36, 37) är lindad kring ett centrumparti (34, 35) hos stången eller plattan.

7. Anordning enligt något av kraven 1-6, kännetecknad av att magnetkärnorna (25, 26; 27, 28) täcker väsentligen hela kokillens (31) bredd, förutom ett centrumparti av kokillen (31).

5 8. Anordning enligt något av kraven 1-7, kännetecknad av att oket (32, 33) innefattar ett från resten av oket (32, 33) lösgörbart anordnat parti (34, 35), vilket parti (34, 35) bär spolen (36, 37).

10 9. Anordning enligt krav 8, kännetecknad av att oket (32, 33) definierar en vagga inrättad att mottaga det parti (34, 35) som bär spolen (36, 37) och tillåta förskjutning av nämnda parti (34, 35) väsentligen vertikalt ur nämnda vagga.

15 10. Anordning enligt krav 9, kännetecknad av att oket (32, 33), förutom nämnda parti (34, 35) som bär spolen (36, 37), innefattar två på motsatta sidor om detta parti (34, 35) anordnade okdelar (38, 39; 40, 41), vilka bildar nämnda vagga och uppvisar var sin yta (46, 47; 48, 49) som är ägnad att anligga mot en respektive magnetkärna (25, 26; 27, 28).

20 11. Anordning enligt något av kraven 1-10, kännetecknad av att oket (32, 33) innefattar åtminstone ett parti (42-45) som är lösgörbart förbundet med resten av oket (32, 33) och inrättat att lösgöras för åtkomst av delar hos anordningen som är anordnade vertikalt under den elektromagnetiska bromsen.

25 12. Anordning enligt krav 11, kännetecknad av att nämnda parti (42-45) är ett periferiparti hos oket (32, 33) som är svängbart anordnad relativt resten av oket (32, 33).

30 13. Ok till en elektromagnetisk broms (24) hos en anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller, innefattande två åtskilda ytor ägnade att lösgörbart anligga mot var sin magnetkärna (25, 26; 27, 28) hos två på en sida av en kokill (31) anordnade magnetkärnor (25, 26; 27, 28), kännetecknat av att det bär en spole (36, 37) som är lindad kring oket (32, 33) väsentligen mellan nämnda ytor (46, 47; 48, 49).

14. Ok enligt krav 13, kännetecknat av att det är långsträckt, att nämnda ytor (46, 47; 48, 49) utbreder sig väsentligen parallellt med dess längdriktning och att spolen (36, 37) är lindad tvärs
5 nämnda längdriktning så att dess centrumaxel är väsentligen parallell med längdriktningen.

15. Ok enligt krav 13 eller 14, kännetecknat av att det innefattar ett från resten av oket lösgörbart anordnat parti (42, 43; 44, 45),
10 vilket parti bär spolen (36, 37).

16. Ok enligt krav 15, kännetecknat av att det definierar en vagga inrättad att mottaga det parti (34, 35) som bär spolen (36, 37) och tillåta förskjutning av nämnda parti (34, 35) väsentligen vertikalt ur nämnda vagga.
15

17. Ok enligt krav 15, eller 16, kännetecknat av att det, förutom det parti (34, 35) som bär spolen (36, 37), innefattar två på motsatta sidor om detta parti (34, 35) anordnade okdelar (38, 39; 40, 41), vilka bildar nämnda vagga och uppvisar de ytor (46, 47; 48, 49) som är ägnade att anligga mot en respektive magnetkärna (25, 26; 27, 28).
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18. Ok enligt något av kraven 13-17, kännetecknat av att det innefattar åtminstone ett parti (42, 43; 44, 45) som är lösgörbart förbundet med resten av oket (32, 33) och inrättat att lösgöras för åtkomst av delar hos anordningen som är anordnade vertikalt under den elektromagnetiska bromsen.
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19. Ok enligt krav 18, kännetecknat av att nämnda parti (42, 43; 44, 45) är ett periferiparti hos oket (32, 33) som är svängbart anordnat relativt resten av oket (32, 33).
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Sammandrag

En anordning för kontinuerlig eller halvkontinuerlig gjutning av metaller innefattar en elektromagnetisk broms som innefattar åtminstone två magnetkärnor (25, 26; 27, 28), anordnade på en sida om och fästade vid en kokill (31), och ett ok (32, 33) som är lösgörbart förbundet med och förbinder de två magnetkärnorna (25, 26; 27, 28). Oket (32, 33) bär åtminstone en spole (36, 37). Spolen (36, 37) är lindad kring oket (32, 33) väsentligen mellan de bägge magnetkärnor (25, 26; 27, 28) som oket (32, 33) förbinder. Oket (32, 33) uppvisar två åtskilda ytor (46, 47; 48, 49) som är ägnade att lösgörbart anligga mot var sin magnetkärna (25, 26; 27, 28), och spolen (36, 37) är lindad kring oket (32, 33) väsentligen mellan nämnda ytor (46, 47; 48, 49).

(Fig. 2)